Mint of the United States at Philadelphia,
MELTING AND REFINING DEPARTMENT,

Philadelphia, 5th November, 1885.

Sir

I have carefully reflected on the letter addressed to me by you on the 17th Ult. in relation to the expenses of running my Department of the Mint, asking for such a plan, as would exhibit at any moment the accurate cost of working the several kinds of metals or the coinage for each day.

After pondering on the subject for the last two weeks and more, I cannot conceive in a remote degree, much less accurately, how such a design can be executed, even to approximate accuracy. If it could be effected, with sure reliability, without which it would be useless, I would use my best endeavors to execute it. I suppose my lack of mercantile business training prevents my inventing a method of accomplishing your object; at all events I have to confess that it is beyond my power, skill or knowledge.

I propose to lay before you the subdivisions of my melting operations, in order that, if possible, you may strike out a practicable method of keeping the account you desire, for I cannot see how to do it.

I will ~~chiefly~~ first consider the Melting of Silver, since that is the chief work in my Department, noting afterwards the variations introduced by Gold, or Base Coinage metal. Since the Government required from my Department $1,700,000 @ $1,800,000 per month and since it requires 2 oz. metal to make 1 oz. of coin, we have been in the practice of melting 3,400,000 @ 3,600,000 Troy ounces of Silver bullion per month, or in A.d.p. pounds, 233,000 @ 247,000 lbs., or in tons 104 to 110 tons to make the 52 to 55 tons of silver ~~daily~~ per month demanded in Coin. Allowing only a day for gathering residues and cleaning up melting rooms, we have to deliver daily to the Coiner 4 1/6 @ 4 4/10 Tons of silver for coinage. If we should be obliged to lose several days, in the Month, beside Sundays, leaving, say, 20 working days, we must deliver to the Coiner over five tons of silver daily.

The total amount in weight does not however express the work executed, for the silver is cast into small ingots, numbering from 2000 to 3800 for a day's work, and these, each one, with extreme care, to avoid loss, in casting.

The working force to execute this amount of coinage is distributed into two sets of men, each set working in a room separate from the other. Each gang is made up as follows:

3 melters, each with a separate furnace = 3
5 helpers to the 3 furnaces = 5
viz. 1 to carry off mold
1 " " on "
1 " open mold
1 " close & grease mold
1 " pick up and pickle the ingots and to take assay granulations
= 8

brot. over	8
1 topper	1
2 filers	2
No in one Melting Gang	11
No in 2nd — " — " —	11
Total in 2 " " s. =	22
One melter engaged nearly the whole of his time in melting the alloying copper	1
One hand who brought up coal for the melting furnaces, and kept the Coal cellars in order.	1
Two weighers, engaged nearly the whole time 1. in delivering ingots — 2. in receiving clippings — 3. in receiving, weighing, and storing silver bars in storage cases.	2
There are three men engaged in Grinding, Riddling, and washing Sweep	3
I have two foremen, one supervising and directing the whole melting Department, and the other, a subforeman, superintending	2
	37

31.

the 2nd Melting Room, and often working himself when required.

There is, beside myself, in the Office, the Assistant Melter & Refiner, who is fully, and sometimes excessively, occupied in the exact calculations for making the standard metal absolutely true, and who also keeps a minute and exact account with the other Departments of the Mint for Bars, Medals, &c. and registers bills paid for the
Department. There is one other, a helper, who 1
keeps the record of Ingots delivered, and clippings received, daily; and who is specially charged with the accounts of our Refining operations with acids, and guarding against loss in Refining, —
and lastly a helper specially detailed to aid 1
the Assistant Melter & Refiner in preparing melts.

Gold Melting. 33

The above list of men and their several duties, are taken from our operations, when melting Silver alone. When Gold is to be melted, we employ one

of the Silver gangs for Silver, and the other for Gold.
Then we employ a special Gold Melter in addtion to 1
to the one set, one who is eminently skilful in melting
to avoid all possible loss by volatilization, or careless
pouring. His duty is further, when not engaged in
gold melting, to work down the grains, resulting from
all our daily work, containing both gold and silver,
by carefully melting these grains, as they are received
from the grinding cellar, and condensing them into Kings,
that can be worked over with good metal, and so recovered.

Connected with Gold melting is the Refining, for which
only two men are actually needed, but as they are only em- 2
ployed about $\frac{2}{3}$ of the month for this purpose, they
are fully occupied in assisting in the melting, especially
of grains, where gold is one of the ingredients and
requires special care.

There is yet one other hand on my roll, a Furnace 1
builder, who is called upon for furnace building
in any part of the Mint, and who, when not so occu-

pied, aids actively in any work in my department. The one gold melter, and the two refiners, are the only additions to the full list of the workmen given above, (page 5), making, with the Furnace builder, thirty seven, (37) as the full force in the Melting and Refining Department.

I have endeavored to discover wherein this force may be diminished in number, but I cannot discover how this is possible without seriously impairing the working efficiency of my Department. For I must be ready at any moment to arrange for Silver and Gold at the same moment, — for Silver and Bronze, — for Gold and Bronze, — for Gold coinage alone — for granulating gold and Silver for Refining Gold, &c. Be it observed, however, that for any of these changes, no new hands are required, — nor, if the order for some metals be intermitted, are idle hands thrown on us, for they are employed equally for heavier work in the Special precious metal or metals, ordered, whether gold or Silver, to gain their time.

I have thus given in some detail the distribution of our working force, in the M & R. Department, and show thereby the impracticability of greater subdivision of men than into two sets, of 11 hands each, = 22 hands, and 15 hands, partly in connection with the 2 melting gangs, and partly as foremen, sweep-grinders, refiners, and weighers, &c. I cannot conceive how these last (15) can be distributed between the two other melting gangs, in their accounts, so as to give a satisfactory result. In short, I cannot conceive how we can make out more than one single account for the whole M. & R. department, nor that account for a less period than one month, so as to embrace the single operation of refining, lasting two or 3 weeks, and only performed once in the month.

The above arrangement of hands, and distribution of work, are the result of many years of experience, and of testing a variety of plans. The objects continually kept in view have been the fewest number of hands, with the fullest occupation of their time, for the highest advantage to the Government, in all the chemical and mechanical processes required to maintain the highest standard of excellence in the Gold and Silver that is tobe coined.

In claiming that I have been successful in attaining these objects most effectually for the last thirty years, I arrogate no unfounded claim; and I would regret to feel obliged to alter a literal success of thirty years, lest it should prove in practice less successful than theory might suggest.

All the preceding statements and remarks result from your letter tome of 17th Oct., conveying the Director's desire to obtain a "daily detailed account" of the running expenses of my department. Where the greater part of the material agents for Melting and Refining are bought at very different times during the month, some at a single purchase & others in very different lots and times. I cannot imagine how a daily detailed account can possibly be kept. We cannot distribute the acid, the charcoal, the Mitts, &c, &c, into daily lots, with any degree of accuracy, or reliability, and without accuracy, the accounts are a waste of time, and valueless.

It would give me great pleasure to execute what the Director desires, but I do not see how to do it. I have never had the opportunity in my life of keeping an account, my whole time having been devoted to Practical Chemistry, and hence it is probable that my inability to strike out a method of keeping a daily account is due to ignorance.

The only approximation to the Director's wish that I can see is to keep a monthly account of expenditures, in order to determine, each month, the relative cost of preparing metals for coinage in my Department.

I have kept several accounts, without reference to the cost of materials employed, for many years past.

In the daily melting of 100,000 @ 160,000, oz. of Silver, I have calculated the standard weight before melting, and at the close of the day we weigh the Ingots melted, with the clippings, &c. unmelted, to determine approximately the loss in the day's melting, and which is determined more accurately after gathering and assaying the grains and pieces from that day's melting, in the course of a few days after their occurrence. I can show such an account for years back from the present time.

In like manner I have kept an account of the refining of gold and silver, to determine the balances of debit and credit account, primarily to be assured of my own security, which is, at the same time, the security of the Government in such transactions.

In all these transactions I never dreamed of keeping an account of the cost of each item employed nor of the quantity employed, because my study has been to effect the operations of my Department at the lowest cost, just as carefully for the Government as for myself. Such has been my study of the Interests of Government, that I assert unhesitatingly that the same results cannot be attained in a less costly manner, except by a total change of method of Refining, and the slight possible difference in cost against the method we pursue, may be balanced by other advantages in favor of it.

You mentioned to me recently that the Director thought our cost of making Silver Dollars far too great. Of course I know nothing of the costs of rolling, cutting stamping and cleaning silver coin after the Silver leaves my Department, but I thought it desirable to ascertain the expense of preparing Silver in my Department for the Coiner. We worked Silver alone during September, 1885. The amount of Cleaned Standard Ingots, which I delivered to the Coiner, in September, was over 3,400,000 oz. Troy., which made over 1,700,000 oz. of coin, or, for all practical purposes and calculations, was $1,700,000= Our expenses incurred in making 1,700000 Silver Dollars, in my Depart-

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ment alone was about $4220.00. Hence the cost of preparing the silver for the Coiner in my Department was just one quarter of a cent for each ounce, or each silver Dollar.

Very Respectfully
Jas C. Booth
M. & R.

Hon. Daniel M. Fox,
Superintendent.

NARA RG104, Entry 1, Box 136

Mint of the United States at Philadelphia,
Melting and Refining Department,
Philadelphia,
November 5, 1885

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His duty is further, when not engaged in gold melting, to work down the grains, resulting from all our daily work, containing both gold and silver, by carefully melting these grains, as they are received from the grinding cellar, and condensing them into kings that can be worked over with good metal, and so recovered.	
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